

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the applications:

Listing of Claims:

1. (Currently Amended) A method for performing logical transformations for global routing in an integrated circuit design, comprising steps of:

(a) determining whether homeomorphism exists between logic trees A and B, wherein said determining comprises:

assigning a value n to a parameter fixed_corr of Na and Nb for a n-th pair (Na, Nb), where Na is a marked node of said logic tree A, Nb is a marked node of said logic tree B, and Na is a corresponding node of Nb; assigning NO FIXED CORR value to fixed_corr for all nodes of said logical trees A and B that are not in pairs of corresponding nodes; and returning an error code when there are marked nodes in said logical tree B for which no corresponding nodes in said logical tree A exist;

assigning a code (a pair (I, a 1 a 2 ... a I) to a node N of said logic trees A and B, where I is a length and a 1 ... a I is an array of integers;

i) when N is a variable, said code is (1, variable number);

ii) when N is a constant, said code is (1, -1); and

iii) when N has children and codes of children are determined as follows:

a) when all children have the code (1, -1), the same code (1, -1) is assigned to N; and

b) (1) when there are several children that are variables with the same variable number, one may leave only one of these children;

(2) when only one significant (i.e., with a code different from (1, -1)) child is left after said (1), and this child has a code (I, a 1 ... a I), the same code is assigned to N if N.fixed corr == NO FIXED CORR; otherwise, code (I+2, 1 N.fixed corr a 1 ... a-I) is assigned to N; and

(3) when several significant children are left after said (1), and codes of these children are (I 1, c 1) ... (I k, c k) (k >= 2) (c j = a j,1 ... a j,c j), these codes are ordered lexicographically (c j(1) <= c j(2) <= ... <= c j(k)) and code (I 1 + ... + I k + 2, k N.fixed corr I j(1) ... I j(k) c j(1) ... c j(k)) is assigned to N; and

establishing homeomorphism between said logic trees A and B when root nodes of said logical trees A and B have the same code;

(b) when homeomorphism exists between said logic trees A and B, assigning same coordinates to nodes of degree != 2 of said logic trees A and B, wherein said assigning same coordinates comprises: ~~for optimizing design parameters~~

(b1) clearing all space occupied by said logical tree A;

(b2) assigning corr node fields for nodes of said logical trees A and B with (number of children != 1) or (fixed corr != NO FIXED CORR) in the following way: corr nodes should have the same code; assigning corr node only for one of these variables when a node has several children that are variables with the same variable number; assign corr node = NULL for nodes with fixed corr = NO FIXED CORR and children number = 1; and returning an error code when one fails to assign corr node to some nodes;

(b3) assigning coordinates to nodes N of said logic tree B with the number of children >= 2 or with fixed corr != NO FIXED CORR; assigning a routing tree to N.corr node; and changing free space to show that a node is added to a field;

(b4) slightly changing correspondence (corr_nodes) for variables to achieve the following: routing positions of corresponding variables should coincide; and for variables with NULL corr_node in said logic tree B, putting routing position = -1;

(b5) assigning variable trees as follows: for each variable, merging a tree of these variables with routing trees of all nodes from said logic tree A that have the only child;

(b6) when a node of said logic tree A has several children that are variables with the same variable number, deleting parts of this variable's routing tree that corresponds to these children except one that does not have NULL corr_node;

(b7) inserting nodes N of said logic tree B with the number of children = 1;

(b8) assigning routing positions to variables that have routing position = -1;

(b9) re-computing delays and caps; and

(b10) clearing a space occupied by said logical tree B, putting back nodes of said logical tree A, and returning a result: an error code or a success code, wherein when the result is a success code, all nodes of B have correct coordinates and routing trees assigned.

2-6. (Canceled)

7. (Currently Amended) An apparatus for performing logical transformations for global routing in an integrated circuit design, comprising:

(a) means for determining whether homeomorphism exists between logic trees A and B, said determining means comprises:

means for assigning a value n to a parameter fixed_corr of Na and Nb for a n-th pair (Na, Nb), where Na is a marked node of said logic tree A, Nb is a marked node of said logic tree B, and Na is a corresponding node of Nb; means for assigning NO_FIXED_CORR value to fixed_corr for all nodes of said logical trees A and B that are not in pairs of corresponding nodes; and means for returning an error code when there are marked nodes in said logical tree B for which no corresponding nodes in said logical tree A exist; and

means for establishing homeomorphism between said logic trees A and B when root nodes of said logical trees A and B have the same code; and

(b) when homeomorphism exists between said logic trees A and B, means for assigning same coordinates to nodes of degree $\neq 2$ of said logic trees A and B; said assigning means comprising: ~~for optimizing design parameters.~~

(b1) means for clearing all space occupied by said logical tree A;

(b2) means for assigning corr_node fields for nodes of said logical trees A and B with (number of children $\neq 1$) or (fixed_corr \neq NO_FIXED_CORR) in the following way: corr_nodes should have the same code; means for assigning corr_node only for one of these variables when a node has several children that are variables with the same variable number; means for assign corr_node = NULL for nodes with fixed_corr = NO_FIXED_CORR and children number = 1; and means for returning an error code when one fails to assign corr_node to some nodes;

(b3) means for assigning coordinates to nodes N of said logic tree B with the number of children ≥ 2 or with fixed_corr \neq NO_FIXED_CORR; means for

assigning a routing tree to N.corr node; and means for changing free space to show that a node is added to a field.

8. (Canceled)
9. (Currently Amended) The apparatus of claim 7 [[8]], wherein said means (a) further comprises:
 - (a2) means for assigning a code (a pair (I, a₁ a₂ ... a_I) to a node N of said logic trees A and B, where I is a length and a₁ ... a_I is an array of integers.
10. (Original) The apparatus of claim 9, wherein in said means (a2):
 - i) when N is a variable, said code is (1, variable number);
 - ii) when N is a constant, said code is (1, -1); and
 - iii) when N has children and codes of children are determined as follows:
 - a) when all children have the code (1, -1), the same code (1, -1) is assigned to N; and
 - b) (1) when there are several children that are variables with the same variable number, one may leave only one of these children;
(2) when only one significant (i.e., with a code different from (1, -1)) child is left after said (1), and this child has a code (I, a₁ ... a_I), the same code is assigned to N if N.fixed_corr == NO_FIXED_CORR; otherwise, code (I+2, 1 N.fixed_corr a₁ ... a_I) is assigned to N; and
(3) when several significant children are left after said (1), and codes of these children are (I₁, c₁) ... (I_k, c_k) (k >= 2) (c_j = a_{j,1} ... a_{j,c_j}), these codes are ordered lexicographically (c_j(1) <= c_j(2) <= ... <= c_j(k)) and code (I₁ + ... + I_k + 2, k N.fixed_corr I_j(1) ... I_j(k) c_j(1) ... c_j(k)) is assigned to N.

11. (Canceled)

12. (Currently Amended) The apparatus of claim 7, wherein said means (b) comprises:

~~(b1) means for clearing all space occupied by said logical tree A;~~

~~(b2) means for assigning corr_node fields for nodes of said logical trees A and B with (number of children != 1) or (fixed_corr != NO_FIXED_CORR) in the following way: corr_nodes should have the same code; means for assigning corr_node only for one of these variables when a node has several children that are variables with the same variable number; means for assign corr_node = NULL for nodes with fixed_corr = NO_FIXED_CORR and children number = 1; and means for returning an error code when one fails to assign corr_node to some nodes;~~

~~(b3) means for assigning coordinates to nodes N of said logic tree B with the number of children >= 2 or with fixed_corr != NO_FIXED_CORR; means for assigning a routing tree to N.corr_node; and means for changing free space to show that a node is added to a field;~~

(b4) means for slightly changing correspondence (corr_nodes) for variables to achieve the following: routing positions of corresponding variables should coincide; and for variables with NULL corr_node in said logic tree B, means for putting routing position ~~position~~ = -1;

(b5) means for assigning variable trees as follows: for each variable, merging a tree of these variables with routing trees of all nodes from said logic tree A that have the only child;

(b6) when a node of said logic tree A has several children that are variables with the same variable number, means for deleting parts of this

variable's routing tree that corresponds to these children except one that does not have NULL corr_node;

(b7) means for inserting nodes N of said logic tree B with the number of children = 1;

(b8) means for assigning routing positions to variables that have routing position = -1;

(b9) means for re-computing delays and caps; and

(b10) means for clearing a space occupied by said logical tree B, means for putting back nodes of said logical tree A, and means for returning a result: an error code or a success code, wherein when the result is a success code, all nodes of B have correct coordinates and routing trees assigned.

13. (Currently Amended) A computer-readable medium having computer-executable instructions for performing a method for performing logical transformations for global routing in an integrated circuit design, said method comprising steps of:

(a) determining whether homeomorphism exists between logic trees A and B, said determining comprising:

assigning a value n to a parameter fixed_corr of Na and Nb for a n-th pair (Na, Nb), where Na is a marked node of said logic tree A, Nb is a marked node of said logic tree B, and Na is a corresponding node of Nb; assigning NO_FIXED_CORR value to fixed_corr for all nodes of said logical trees A and B that are not in pairs of corresponding nodes; and returning an error code when there are marked nodes in said logical tree B for which no corresponding nodes in said logical tree A exist; and

establishing homeomorphism between said logic trees A and B when root nodes of said logical trees A and B have the same code; and

(b) when homeomorphism exists between said logic trees A and B,

assigning same coordinates to nodes of degree $\neq 2$ of said logic trees A and B,
said assigning same coordinates, comprising: for optimizing design parameters

(b1) clearing all space occupied by said logical tree A;

(b2) assigning corr node fields for nodes of said logical trees A and B with (number of children $\neq 1$) or (fixed corr \neq NO FIXED CORR) in the following way: corr nodes should have the same code; assigning corr node only for one of these variables when a node has several children that are variables with the same variable number; assign corr node = NULL for nodes with fixed corr = NO FIXED CORR and children number = 1; and returning an error code when one fails to assign corr node to some nodes;

(b3) assigning coordinates to nodes N of said logic tree B with the number of children ≥ 2 or with fixed corr \neq NO FIXED CORR; assigning a routing tree to N.corr node; and changing free space to show that a node is added to a field;

(b4) slightly changing correspondence (corr nodes) for variables to achieve the following: routing positions of corresponding variables should coincide; and for variables with NULL corr node in said logic tree B, putting routing position = -1;

(b5) assigning variable trees as follows: for each variable, merging a tree of these variables with routing trees of all nodes from said logic tree A that have the only child;

(b6) when a node of said logic tree A has several children that are variables with the same variable number, deleting parts of this variable's routing tree that corresponds to these children except one that does not have NULL corr node;

(b7) inserting nodes N of said logic tree B with the number of children = 1;

(b8) assigning routing positions to variables that have routing position = -1;

(b9) re-computing delays and caps; and

(b10) clearing a space occupied by said logical tree B, putting back nodes of said logical tree A, and returning a result: an error code or a success code, wherein when the result is a success code, all nodes of B have correct coordinates and routing trees assigned.

14. (Canceled)

15. (Currently Amended) The computer-readable medium of claim 13 [[14]], wherein said step (a) further comprises:

(a2) assigning a code (a pair (I, a₁ a₂ ... a_I) to a node N of said logic trees A and B, where I is a length and a₁ ... a_I is an array of integers.

16. (Original) The computer-readable medium of claim 15, wherein in said step (a2):

- i) when N is a variable, said code is (1, variable number);
- ii) when N is a constant, said code is (1, -1); and
- iii) when N has children and codes of children are determined as follows:
 - a) when all children have the code (1, -1), the same code (1, -1) is assigned to N; and
 - b) (1) when there are several children that are variables with the same variable number, one may leave only one of these children;
(2) when only one significant (i.e., with a code different

from (1, -1)) child is left after said (1), and this child has a code (I, a₁ ... a_I), the same code is assigned to N if N.fixed_corr == NO_FIXED_CORR; otherwise, code (I+2, 1 N.fixed_corr a₁ ... a_I) is assigned to N; and

(3) when several significant children are left after said (1), and codes of these children are (I₁, c₁) ... (I_k, c_k) (k >= 2) (c_j = a_{j,1} ... a_{j,c_j}), these codes are ordered lexicographically (c_j(1) <= c_j(2) <= ... <= c_j(k)) and code (I₁ + ... + I_k + 2, k N.fixed_corr I_j(1) ... I_j(k) c_j(1) ... c_j(k)) is assigned to N.

17. (Canceled)

18. (Canceled)